

*MIMOSELLA COOKAE*, NEW SPECIES  
(BRYOZOA, CTENOSTOMATA), WITH  
A REVIEW OF THE FAMILY MIMOSELLIDAE.

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INTRODUCTION

The genus *Mimosella*, widespread throughout Europe, eastern Africa, the Atlantic, West Pacific and Indian Oceans (Harmer, 1915); Prenant and Bobin, 1956), has not been previously recorded from the East Pacific, probably because the animals are small and easily overlooked. The species described here, *Mimosella cookae*, was collected at Guadalupe Island, on the western side of Baja California. Specimens are well preserved and in reproduction, so it is possible to observe some important aspects of the morphology of this unusual genus.

Family Mimosellidae, Hincks, 1851

Genus *Mimosella*, Hincks, 1851

*Mimosella cookae*, new species

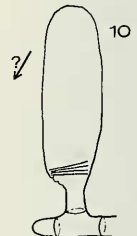
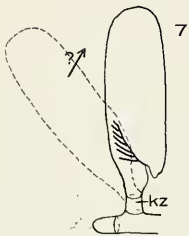
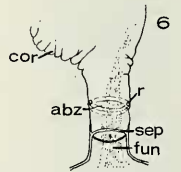
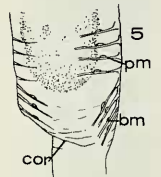
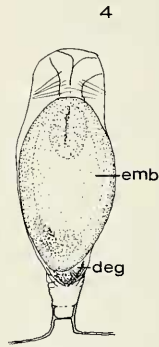
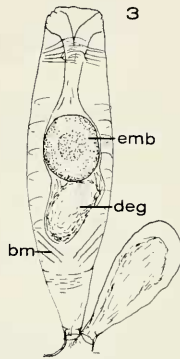
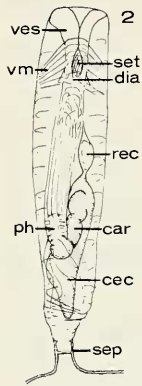
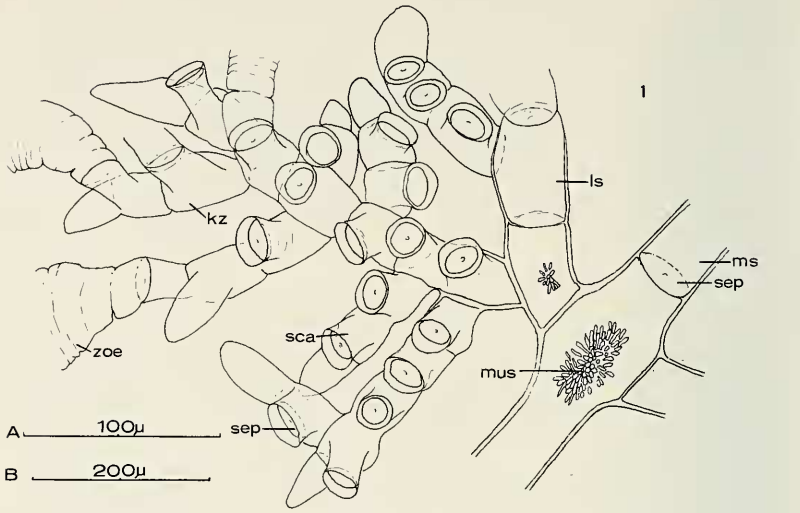
*Type locality.* Guadalupe Island, Baja California, 29°, 11' N; 118°, 17' W; between Outer Island and South Bluff. Several tangled colonies adhering to floating algae.

*Holotype.* Several colonies fixed in 10% formalin. Deposited at the Allan Hancock Foundation, the University of Southern California, Los Angeles, California. AHF type 651; bryozoan type 153.

*Paratype.* Several colonies at the British Museum (Natural History), London.

*Name.* Dedicated to Miss Patricia L. Cook of the British Museum (Natural History).

*Diagnosis.* Colony composed of one or a few main stolons with adnate lateral stolons and predominantly uniserial clusters of kenozoids, each bearing a single autozoid. Muscles present in stolons and Kenozoids. Peduncles of autozoids short, each bearing an annular abscission zone. Autozoids possess a thin, corrugated "articulation" region on the abneural side of the zoecium just distal to the peduncle.



Basal muscles bilateral, separate, inserting distal to the corrugated zone. Embryos brooded in the tentacle sheath.

*Description.* Each colony consists of a single main stolon with periodic short lateral branches which give rise to kenozoids bearing elongated autozooids (Fig. 1).

The main stolon consists of a series of elongate tubular autozooids separated by septa occurring at intervals of about 1 mm (0.7–1.3 mm); distal internodes are shorter than proximal ones. Septa are circular transverse plates perforated by a central pore, as is usual in stolonate Bryozoa (Fig. 1, *sep*). Methacrylate sections demonstrate that the communication pores are plugged by 2-4 special cells surrounded by a tiny pore cincture. A pair of lateral stolons emanate from the main stolon at a swelling just proximal to each septum; they likewise are separated by septa (Fig. 1). Lateral stolons may produce other lateral stolons or may branch into a series of small kenozoids (35-40 in either dimension). Each kenozoid bears a short process which expands into an autozoid.

Within the cavity of the main stolon, just proximal to each septum, there are massive muscles which extend from the basal to the frontal surface (Fig. 1, *mus*). Similar muscles can be seen in toluidine blue-stained methacrylate sections of lateral kenozoids, but they are not visible in whole mounts. Neither frontal nor basal surfaces of stolons or kenozoids are modified at the insertions of the muscle fibers. Similar muscles are present in a number of stoloniferous ctenostomes (see Silén, 1950); their functions are unknown.

*Figures 1-6 Mimosella cookae*, new species; glycerine jelly whole mounts of paratype material. 1, base of colony, showing mode of branching, zoecial scars and stolonal muscles; scale A. 2, Mature autozoid; scale B. 3, brooding autozoid with young embryo, showing relation of embryo to zoid membranes; scale B. 4, brooding autozoid with an advanced embryo; scale B. 5, base of an autozoid, showing basal and parietal muscles; scale A. 6, peduncle of an autozoid, showing morphology of the abscission zone; scale A.

*Figures 7-10.* Diagrammatic representations of mimosellid autozooids, showing varying morphologies and actions of basal muscles. Arrows indicate presumed directions of movement of zoecia when basal muscles contract; in no case has the actual motion of living animals been adequately described. 7, *Mimosella bigeminata* (after Silén, 1950); dashed outline indicates position of zoecium when basal muscles are relaxed. 8, *M. verticillata* (after Marcus, 1937 fig. 9). 9, *M. cookae*. 10, *M. firmata* (after Marcus, 1938 pl. 14, fig. 34B).

*Abbreviations:* *abz*, abscission zone; *bm*, basal muscles; *car*, middle chamber of cardium; *cec*, cecum; *cor*, corrugated thin region of cuticle; *deg*, degenerated polypide; *dia*, diaphragm; *emb*, embryo; *fun*, funiculus; *kz*, kenozoid; *ls*, lateral stolon; *ms*, main stolon; *mus*, stolonal muscles; *ph*, pharynx; *pm*, parietal muscles; *r*, cuticular ring near abscission zone; *rec*, rectum; *sca*, scar of shed autozoid; *sep*, septum; *set*, setigerous collar; *ves*, vestibule; *vm*, vestibular muscles; *zoe*, zoecium of an autozoid.

Old autozooids are shed like leaves; most zooids still attached to the colony are healthy, so zoecia are presumably dropped off as soon as they are dead. This habit, which Harmer (1915) has aptly termed "deciduous", is associated with a modification of the cuticle (see below). Each kenozooid bears only one autozooid; this feature distinguishes *M. cookae* from all other members of the genus.

Functional autozooids are elongate, nearly cylindrical, and measure about  $400\ \mu$  ( $350$ - $500\ \mu$ ) long, by  $70\ \mu$  ( $50$ - $100\ \mu$ ) wide. The orifice is drawn into a quadrangular shape by the tension of the vestibular musculature. There is a distinct setigerous collar (Fig. 2, *set*). The pharynx leads into a complex cardium consisting of three parts (Fig. 2, *car*); the middle chamber is surrounded by fine circular fibers, presumably muscles. The cecum or "stomach sac" leads directly into the rectum [= intestine]. Testes, when developed, fill most of the body cavity from the level of the proximal end of the cecum to the diaphragm. Ovaries are absent in the specimens examined, but many zooids are brooding.

Embryos are brooded in the tentacle sheath. Polypides probably begin to degenerate as soon as larvae are set in place, because even very young larvae (less than  $20\ \mu$  long) are located in zoecia in which the polypides have almost completely degenerated. The relationship of the larva to the zoid's membranes are best seen when the embryo is small (Fig. 3), because older larvae become quite large (largest measured:  $230 \times 115\ \mu$ ; fig. 4, *emb*), filling almost all the available space within the zoecium. Parietal, vestibular and basal muscles remain intact; the first two probably aid in expulsion of the embryo.

The base of the zoid is not perfectly round. The anal side of the zoid near its attachment to basal kenozooid, is folded inward ventrally and bears hemicircular corrugations (Fig. 6, *cor*). The zoecial flexor (erector?) muscles, here called basal muscles, are difficult to see because they are poorly developed and easily confused with the retractors of the lophophore, which originate near them. For this reason, basal muscles are best observed in brooding zooids, in which retractors are absent.

Basal muscles consist of two, three, or at the most, four pairs of fibers originating bilaterally on the proximal zoid wall. Both Joliet (1877) and Silén (1950) have suggested that basal muscles are serially homologous to parietal muscles. The basal muscles of *M. cookae* appear to corroborate this theory; their origins are in the same vertical plane as those of parietals, and they are spaced at intervals about equal to the distance between parietals. They insert independently into the dorsal [anal, or neural] side of the zoecium. The only reliable character

distinguishing parietal muscles from basal muscles in *M. cookae* is that basal muscles do not run circumferentially, but insert relatively more proximally than parietals (Fig. 5, *bm*).

The insertion of the parietals distal to the corrugated region suggests that their contraction flexes, rather than extends the zoecium. This suggestion must remain speculative, however, since live animals have not been observed, and it is not certain that the zoecia move at all.

Just proximal to the corrugated area in the zoecial cuticle, the zoecium narrows and the cuticle thickens into a short, tough tube. The proximal end of the tube is limited by the septum, while the distal limit appears to be the zone at which abscission of the zoecium takes place. The abscission zone is marked by a tiny groove (Fig. 6, *abz*) and, just distal to it, a cuticular ring of reinforced ectocyst (*r*). "Scars" of shed zoecia are marked on kenozoids by short tubes with septa near, but not at, the end (Fig. 1, *sca, sep*).

#### DISCUSSION

*Basal muscles.* The morphology of basal muscles in *M. cookae* differs from that of the other known species of *Mimosella*. In *M. bigeminata* Waters, basal muscles are paired, fan-shaped bundles of fibers which originate on the dorsal side, unite into a single tendon, and insert just proximal to the thinned, flexible region (Harmer, 1915). According to Silén (1950), the action of the muscles is probably erection of the zoecia from the flexed position, with the dorsal side pressed next to the stolon (Fig. 7). The erection is presumably opposed by the resilience of the cuticle. This cannot be the case in *M. cookae*, however, because muscles insert distal to the corrugated region.

Marcus (1937) has described an animal from Santos Bay, near São Paulo, Brazil, in which the basal muscles insert distal to the thinned area. The arrangement differs from that of *M. cookae*, however, because the thinned area of the former is on the dorsal side of the zoecium (Marcus, 1937). If the zoecia move at all, it seems probable that basal muscles flex, rather than erect them, and that flexing must be toward the anal side (Fig. 10). This is opposite the direction of flexion proposed for *M. cookae* (Fig. 9).

Joliet (1877), who apparently observed live *Mimosella verticillata*, observed that bilateral muscles originate on the proximal zoecial wall and insert on the "peduncle", the narrow proximal part of the zoid. He described "natation" as a bending of the peduncle. Harmer (1915) illustrates the insertion of basal muscles at a constriction of the peduncle, which he calls the "diaphragm". It appears that this "diaphragm"

may represent the abscission zone. Harmer stated that his observations "agree exactly" with those of Joliet, but their descriptions of the structure of the peduncle and insertions of basal muscles differ. Neither author indicated whether basal muscles originate on the dorsal or the ventral sides of zoecia.

Silén (1950:361, 363) apparently observed that the basal muscle insertions of *M. verticillata* are similar to those of *M. bigeminata*. His discussion indicated that the muscles originated on the anal side and insert on the abanal side (Fig. 7). He seemed to have reversed the polypide in his diagram, however (p. 363, fig. 12, on the left). Marcus (1938:224, fig. 32), on the other hand, illustrated exactly the opposite situation. He showed the muscles originating on the dorsal side; parietals originate ventrally. Furthermore, the polypide is oriented so that the dorsal side faces the older (inner) portion of the colony. This is contrary to the situation in the rest of the Eurystomata (Silén, 1944). According to Marcus, basal muscles insert on the septum, so contraction must result in flexion toward the center of the colony (fig. 8).

In view of the contradictions in the literature, it is probably unwise to draw any firm conclusions about movements caused by contraction of basal muscles. This is especially true since movements of live mimosellids have not been recorded since the descriptions by Hincks (1851; 1880) and Joliet (1877).

*The abscission zone.* Silén (1950:359) described a "very small kenozoid between the stolon and the autozoid" in *M. bigeminata* Waters (Fig. 7, kz). Silén's observations were made on Harmer's (1915) material, but neither Harmer (1915) nor Waters (1914), figured basal kenozoids. In *M. cookae* the proximal portion of the stolon between the septum and the abscission zone does indeed resemble a kenozoid (Fig. 6), but toluidine blue-stained methacrylate sections clearly show that there is no septum at the abscission zone.

Basal kenozoids, however, do occur in *M. bocki* Silén; each autozoid bears three or four kenozoids at its base (Silén 1942). Prenant and Bobin (1956): illustrated occasional basal kenozoids in *M. gracilis* Hincks, 1851, but I have not been able to observe them in my material of the same species (from the Norman collection, collected at Santos Bay, Guernsey), presented to me by Patricia L. Cook of the British Museum (Natural History). The abscission zone in this species is very close to the septum.

*Affinities.* The species of *Mimosella* fall into two groups. The first group consists of predominantly erect forms in which autozoids originate directly from the main stolon or are borne on a short series (1-4) of basal kenozoids. If more than one basal kenozoid is present, those

between the distal kenozoid and the main stolon are barren. This condition produces colonies in which autozooids are regularly spaced along the main stolon like leaflets on the sensitive plant, *Mimosa*, from which the generic name is derived. This group includes: (1) the genotype, *Mimosella gracilis* Hincks, 1851; (2) *M. bigeminata* Waters, 1914; and (3) *M. bocki* Silén, 1942.

The second group consists of adnate species in which the main stolon creeps along the substrate and is anchored by lateral stolons. Lateral stolons are usually short and barren, but give rise to small kenozoids which bear either one or two autozooids, depending on the species. This arrangement produces colonies in which autozooids are grouped in bunches along the main stolon. Included in this group are (1) *Mimosella verticillata* (Heller, 1867); *M. firmata* Marcus, 1937; (3) *M. tenuis* Harmer, 1915; (4) *M. cookae* n. sp.; and (5) a doubtful species, *M. tremulans* (Hincks, 1862). "*M. elegans* Richiardi" apparently remains a manuscript name (see Prenant Bobin, 1956).

Marcus considered his Bahía de Santos specimens a subspecies (var. *firmata*) of *M. verticillata* Waters, but it is herein regarded as a separate species for the following reasons: (1) zooids of *M. firmata* are somewhat shorter (500-600  $\mu$ ) than those of *M. verticillata* (500-800  $\mu$ ; Marcus, 1937) (2) the diaphragm of *M. firmata* is farther proximal than that of *M. verticillata*; (3) *M. firmata* possesses specialized kenozoids called "adhesive discs", absent in *M. verticillata*; (4) the arrangement of basal muscles is entirely different in the two species (compare Figs. 8 and 10).

*M. cookae* appears most closely related to *M. firmata* Marcus, but it differs from the latter in a number of respects, including the following: (1) *M. cookae* lacks adhesive discs, present in *M. firmata*; (2) *M. cookae* possesses one autozoid per kenozoid; kenozoids of *M. firmata* normally bear two, although occasionally there may be only one; (3) the diaphragm is located in the distal quarter of the zoecium in *M. cookae*, but is much farther proximal (near the middle) in *M. firmata*.

Mimosellids are apparently closely related to the family Valkeriidae; in fact, the only reliable character separating the families is the presence of basal muscles in *Mimosella*. Both families possess erect or adnate colonies with deciduous autozooids, without gizzards, usually borne on kenozoids. Hincks (1862) described a species which he called *Valkeria tremulans*, which he records undergoes flexing movements as the polypide is retracted (Hincks, 1880). There is nothing to suggest that this species is not a *Mimosella*, perhaps identical to *M. verticillata* (but see Hincks, 1880:548). The close relationship between the two

families is further substantiated by the morphological resemblance of the basal muscles to parietals in *M. cookae*.

Soule (1954), without explanation, included *Hypophorella* Ehlers, 1876 in the Mimosellidae. *Hypophorella* had long been placed in the Valkeriidae [= Walkeriidae] Hincks 1880 (see Marcus, 1940 and Borg, 1930). In my opinion, *Hypophorella* does not belong in either family; *Hypophorella* possesses "protective vessicles", highly aberrant vestibular musculature, and a strongly developed boring apparatus, none of which are present in any of the Valkeriidae or Mimosellidae. Furthermore, there are differences in reproductive habits. Prouho (1892) described the larva of *H. expansa* Ehlers, 1876 as a cyphonautes; eggs are extruded through a supraneural pore. Larvae of *Mimosella cookae* are brooded in the tentacle sheath; larvae of *Valkeria uva* (Linné, 1758) are brooded, but it is uncertain where (Barrois, 1877). *Hypophorella*, therefore, appears to be sufficiently distinct to be placed in a separate family, the Hypophorellidae (Joyeux-Laffuie, 1888a, b; Prenant and Bobin, 1956). Prenant and Bobin (1956) appear to be the authors of the Hypophorellidae, even though they did not recognize that the taxon was new (International Congress of Zoology, sec. 4, arts. 11e and 13a). Brien (1960) ascribed the family to "Soule, 1854" [sic], but this is incorrect.

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